

## *TIME OF FLIGHT*

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## INSTRUCTION MANUAL

### **25mm MCP MICROCHANNEL PLATE Z-GAP DETECTOR FOR ION TRAP ANGULAR REFLECTRON (ITAR)**

Updated Feb 19, 2016

**TABLE OF CONTENTS**

	<u>PAGE</u>
1.0 SPECIFICATIONS .....	1
2.0 GENERAL DESCRIPTION .....	1
3.0 INSTALLATION .....	1
4.0 INITIAL CHECK OUT .....	2
5.0 MAINTENANCE .....	3



## 1.0 **SPECIFICATIONS**

### 1.1 MECHANICAL SPECIFICATIONS

Ground Plane grid diameter (input aperture) 1.30 inches  
Grid transmission, 90%  
Active surface area diameter, 1.00 inches  
Distance from Input Grid to face of vacuum flange, 1.75 inches  
Maximum protrusion from flange face into vacuum system, 2.00 inches  
Minimum tube I.D. for vacuum housing, 2.75 inches  
Maximum bakeout temperature, 150EC

### 1.2 MATERIAL SPECIFICATIONS

#039 O-Ring, Viton  
Structural plates, connectors, fasteners and grids, 304 stainless.  
Channel plate spacer and contact pads, nickel.  
Insulator spacers, alumina.  
Anode face pad, 304 stainless.  
Anode and Anode Shield, 6061 Aluminum.  
Microchannel Plates, Galileo MCP-25B or equivalent. Diameter, 1.30 Thickness, .016-.018 in. Channel diameter, 10 micron. Channel spacing 12.5 microns MAX.

### 1.3 ELECTRICAL SPECIFICATIONS

Maximum voltage across each plate, 1000 volts.  
Gain, 1000 minimum per plate at 1000 volts Gain is down approximately one decade at 700 volts per plate.

## 2.0 **GENERAL DESCRIPTION**

This detector is designed to handle the fast ion pulses provided by the Time of Flight Mass Spectrometer. It has 50 ohm output and provides high gain with sub-nanosecond rise time. It is fitted with an input grid wired to an external SHV Feedthrough. This can be grounded using the ground cap provided or shorted to liner by use of an SHV "T". This presents a flat, field-free plane to the incoming ions.

Shipped mounted on a 4 ½, 6 inch or larger CONFLAT flange. Baked and pinched off in its own vacuum housing.

## 3.0 **INSTALLATION**

### 3.1 VACUUM

Do not open the vacuum housing until ready to install the detector in the vacuum system. Repeated brief exposure to air will not damage the plates. Extended exposure will allow the plates to absorb sufficient amounts of water to distort and crack.

Allow the detector to pump to below  $1 \times 10^{-6}$  Torr and remain there for 12-16 hours before applying voltage.

### 3.2 **ELECTRICAL**

If your Jordan TOF Products, Inc. power supply has an internal voltage divider, the front panel meter will read the value of VD1. VD1, VD2, and VD3 cables are connected to the rear of the power supply chassis. If the VD4 is missing, this power supply is for use with a dual MCP only, not Z-Gap.

If your Jordan TOF Products, Inc. power supply uses an external voltage divider box, the front panel meter will read the value of the voltage to the input of the divider box (VD = 0 to -5kV). VD1, VD2, and VD3 cables are connected to the output of the divider box. The divider box will be labeled "Dual MCP Detector".

The Z-Gap detector uses a special Z-Gap divider box. The front panel meter reads the value of the voltage to the input of the divider box (VD = 0 to -5kV). VD1, VD2, VD3, and VD4 cables are connected to the output of the divider box. The divider box is labeled "Z-Gap Detector".

**BE SURE YOU ARE USING THE CORRECT DIVIDER BOX. USE OF THE WRONG DIVIDER BOX WILL DESTROY THE DETECTOR.**

An SHV "T" and cable are used to connect the input grid (G) to flight tube liner potential (a shorting cap can be used to ground G if a liner is not used).

If you wish to use a different power supply, it is recommended that you purchase an external divider box from Jordan TOF Products, Inc., to insure proper distribution of voltages to the detector (see Figure 1).

### 4.0 **INITIAL CHECK OUT**

Connect the signal cable to the vertical input of an oscilloscope with 1 M $\Omega$  impedance and sensitivity in the 10 millivolt range.

Slowly increase the voltage while watching for arcing and excess noise spikes. When the plates have a large amount of gas on the surface, pulse frequency can become high enough to actually cause a DC offset at the anode.

If the noise is more than a few pulses per second, turn up the voltage until they just appear and wait. This is the "turn on voltage". The noise should decrease with time. Repeat this until the desired voltage level is reached. For a fresh detector, the "turn on voltage" (VD) is 2500-3000V. This corresponds to about 500 to 700 volts per plate. If you do not observe a signal at 2,900V, there is a problem somewhere else in the system.

If arcing occurs for any reason such as a gas burst, turn down the voltage to avoid sustained arcing. Arcing is usually the result of dust or rough spots on the plates or electrical contact surfaces. It can usually be corrected by disassembling, blowing the plates with dry gas and reassembly with the top plate reversed. If this doesn't work, repeat the procedure, reversing the middle plate.

#### 4.1 OPERATION

If the channel plate detector is satisfactory after the initial steps above, it is ready to be used for ion detection. Be sure to terminate signal into a 50 $\Omega$  load.

It is best to keep the plates under vacuum. If it is necessary to go to atmospheric pressure it should be done with dry nitrogen or dessicated air if possible.

There are 2 primary mechanisms for deterioration of gain. One is coating of the front face from ion bombardment. This will be in proportion to sample pressure and ion beam intensity. The second occurs within the channels near the output side of the plates where high electron currents can bombard the surfaces and cause depletion of the oxides and polymerization of surface species.

The best way to avoid both of these is to not generate more signal than you need. Reduce the gain and sample pressure whenever possible to extend the life of the detector.

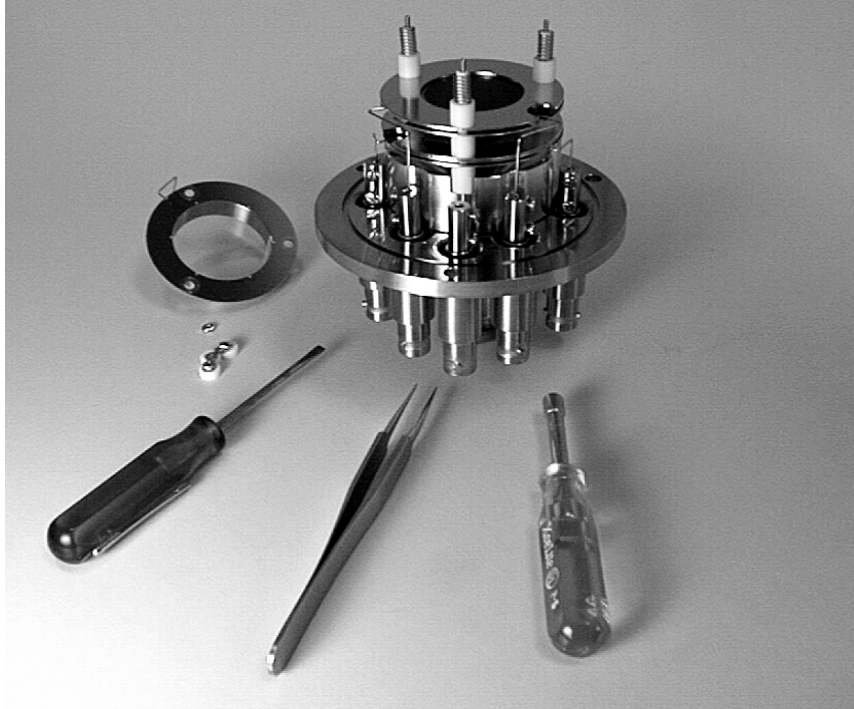
#### 5.0 MAINTENANCE

It is strongly recommended that the assembly be returned to the manufacturer for any cleaning of metal or ceramic parts. Where this is not possible, replacements for all parts which normally need cleaning can be obtained from Jordan TOF Products, Inc.

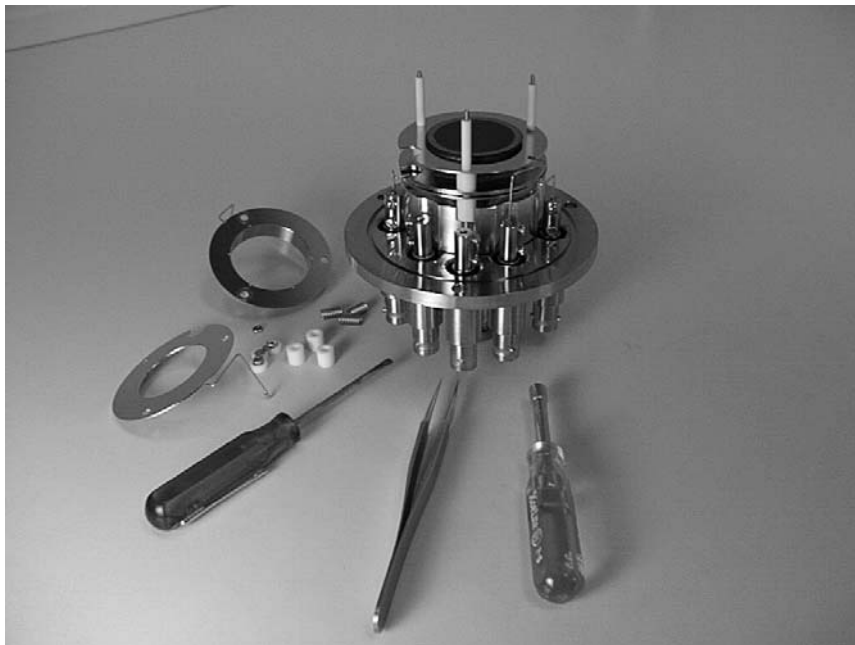
Eventually it will be necessary to replace depleted channel plates.

This is done as follows:

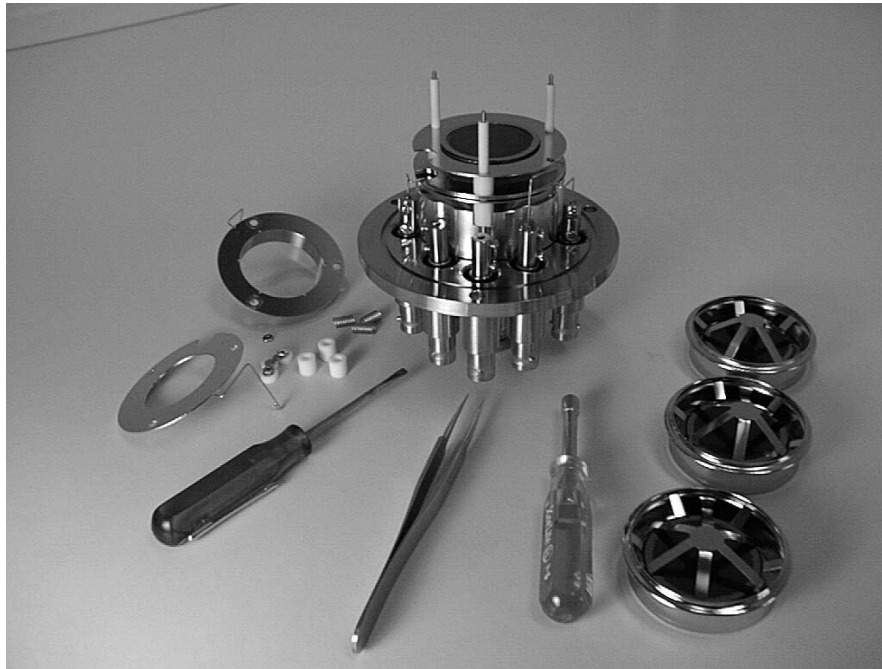
All the following operations must be done in a dust free area with the usual precautions against fingerprints, etc.



1. Remove nuts, washers and ceramic spacers. Disconnect lead from barrel connector and lift off Input Grid being careful not to damage mesh.



2. Remove springs and insulators.
3. Disconnect lead from D4 barrel connector and lift off top (hold down) plate from Channel Plate Stack assy.

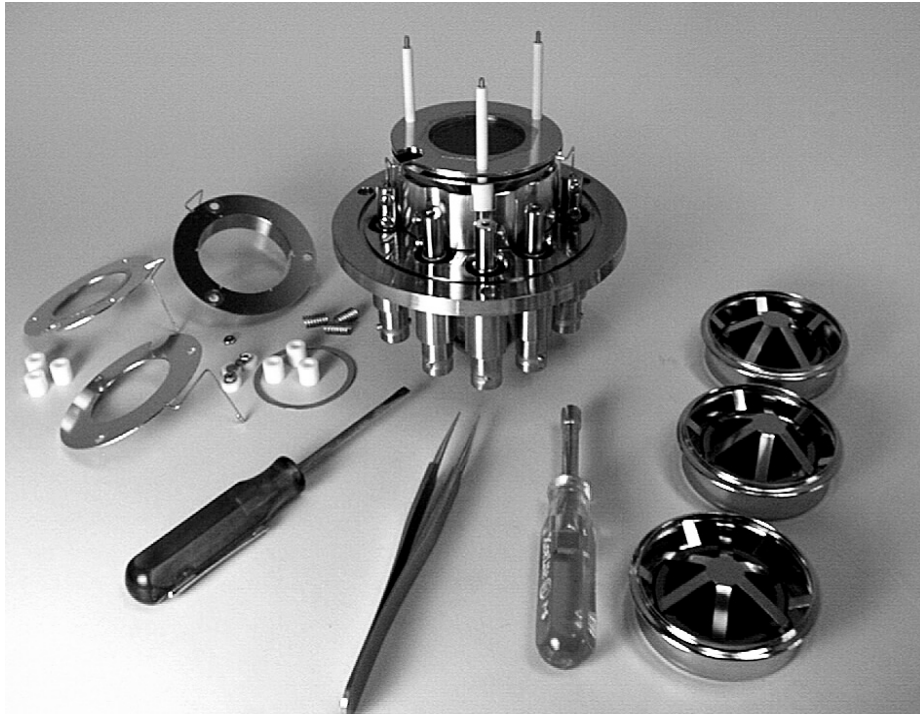


4. Remove top channel plate.

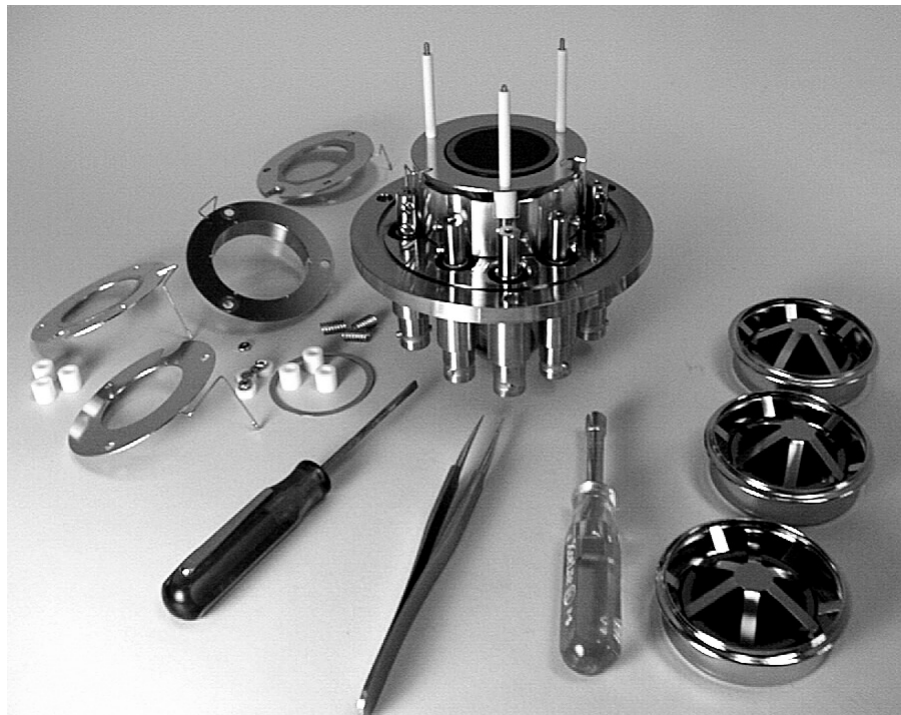


5. Remove Spacer and channel plate.

6. Disconnect lead from D1 barrel connector.
7. Remove Hold Down Plate and ceramic spacers.

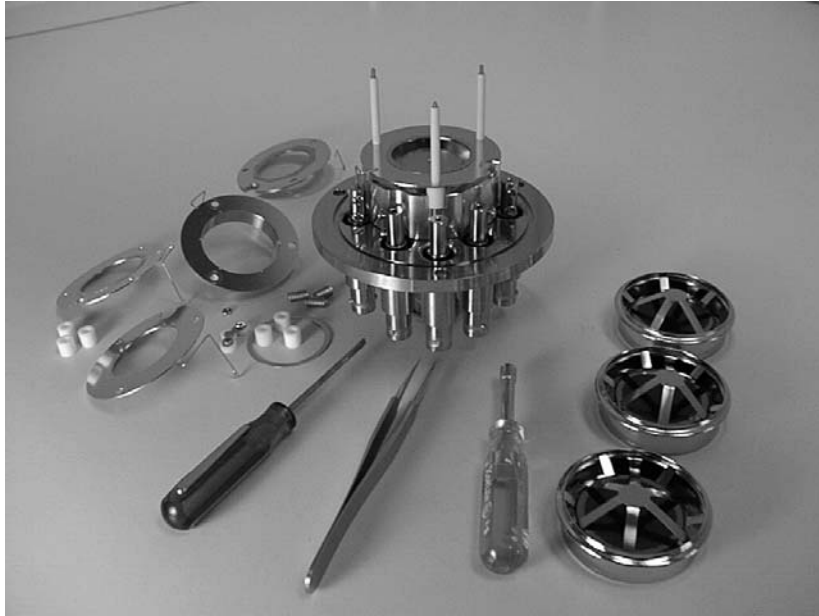


8. Disconnect lead from D2 barrel connector. Remove suppression grid and hold down plates being careful not to damage grid.

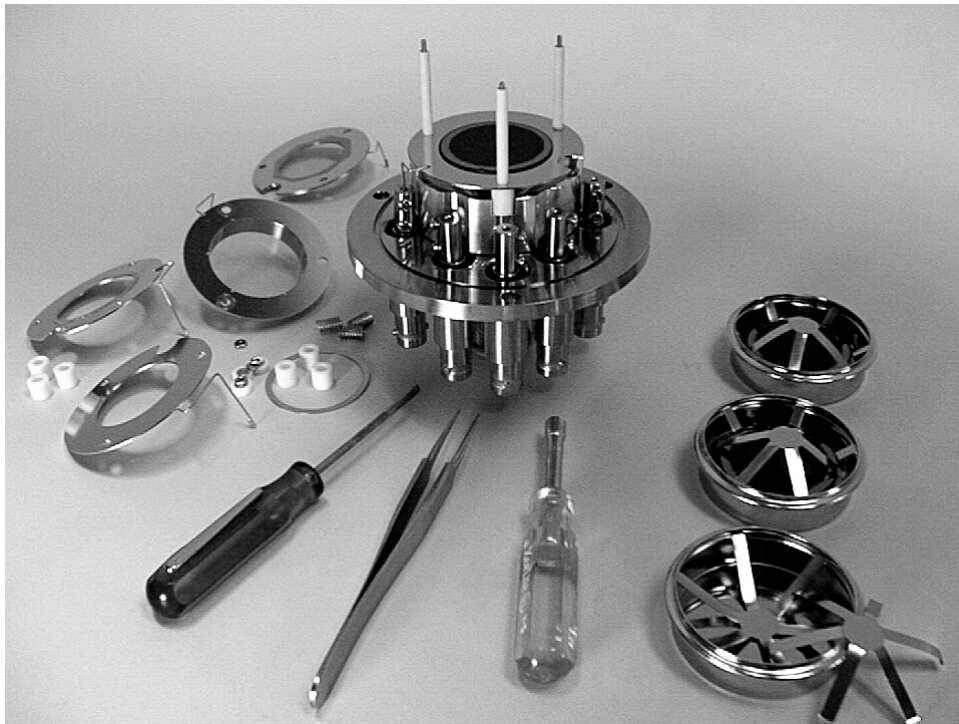




9. Remove bottom channel plate.

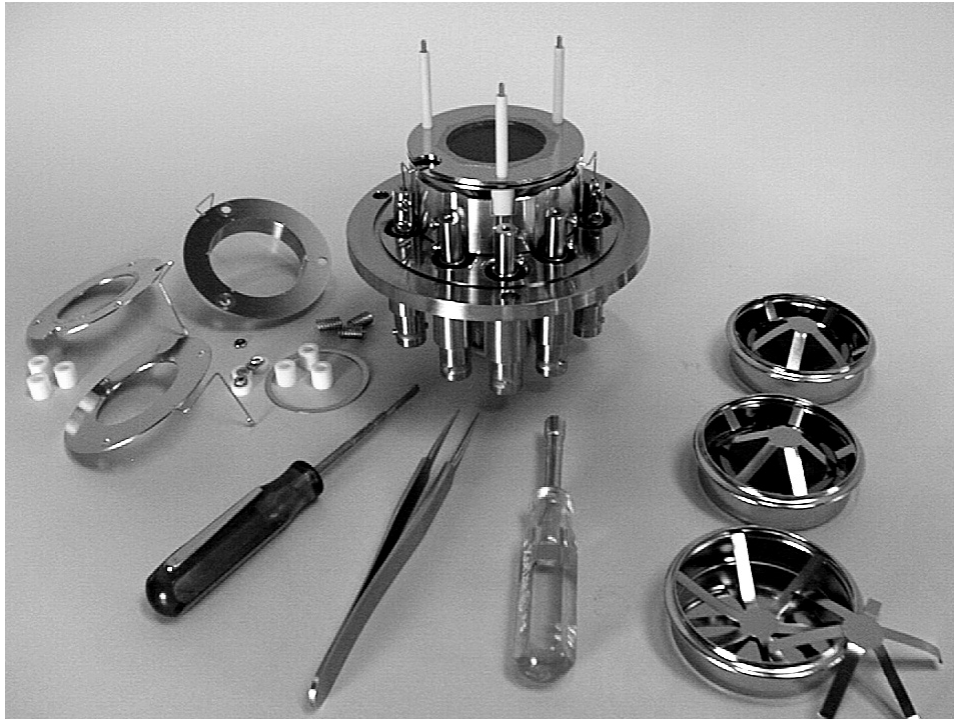


10. Take a new channel plate from its shipping container being careful to handle it by the outer rim. Blow off any dust with dry nitrogen or clean, dry compressed air. Do not use canned Freon. Do not allow anything to contact active area on microchannel plate as this will cause plate to be noisy.

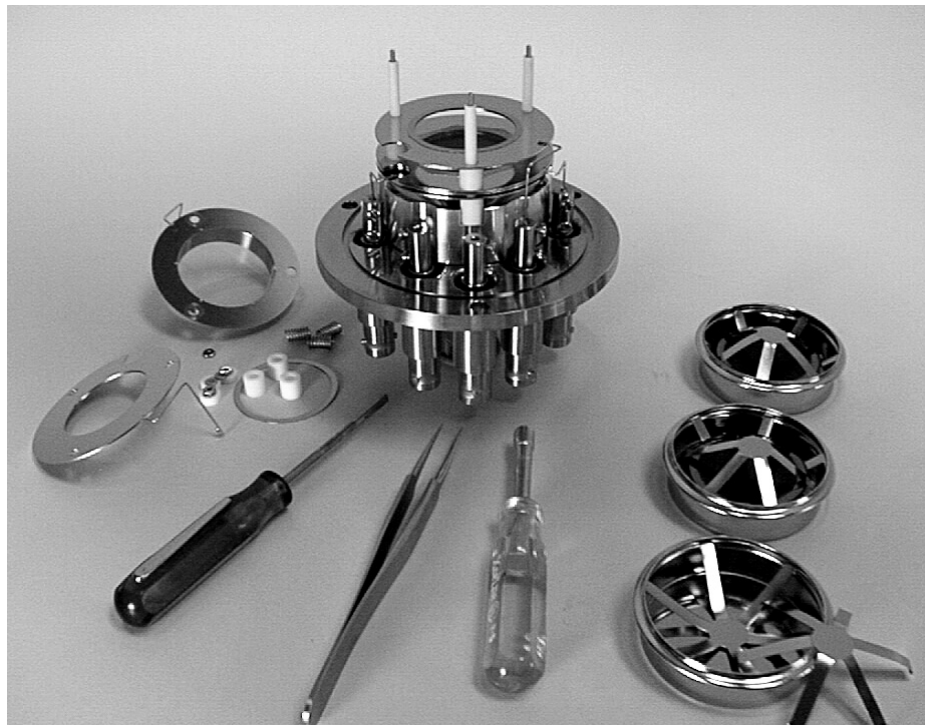


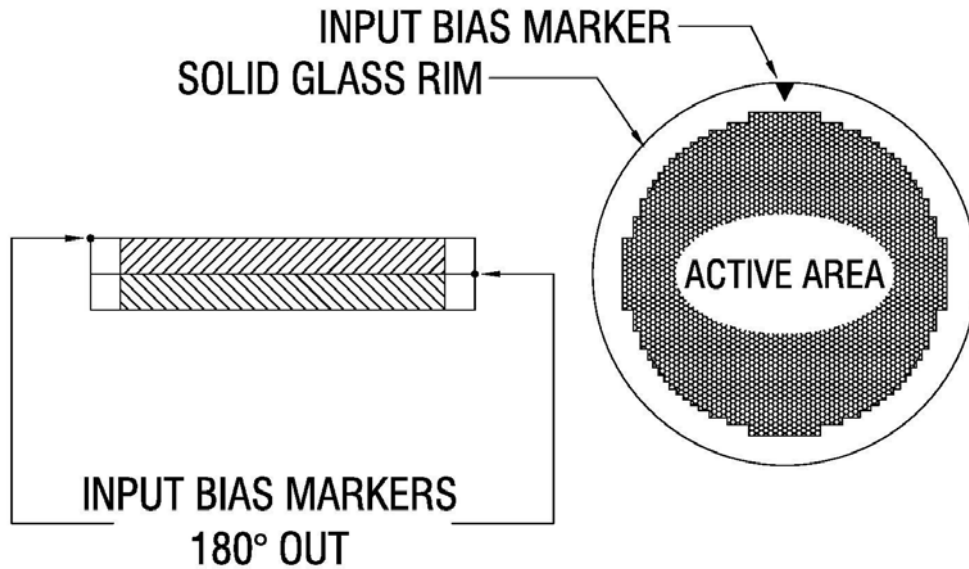
11. Put this plate on base and center it.

12. Reinstall hold down plate and suppression grid. Insert its lead into D2 barrel connector. Do not tighten the connector screw.

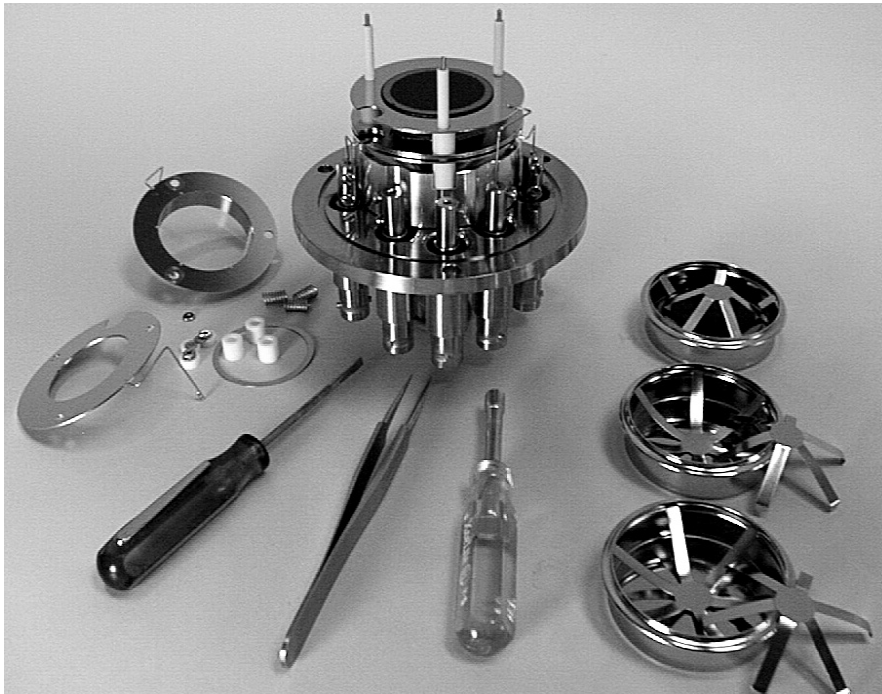


13. Replace ceramic insulators and hold down plate. Guide lead into D1 barrel connector. Do not tighten the connector screw.



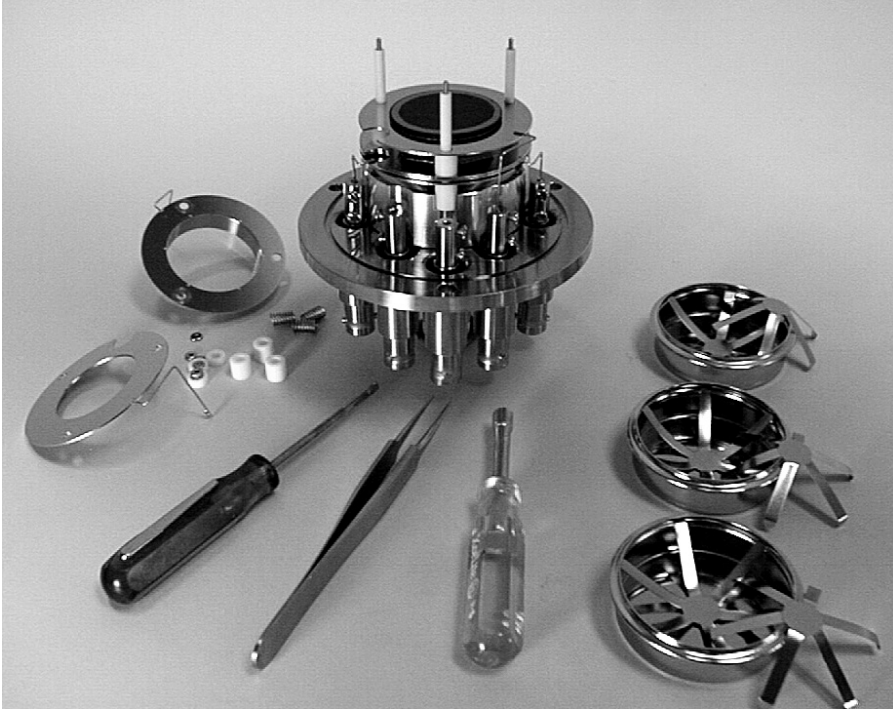


- Take another new channel plate from its shipping container being careful to handle it by the outer rim. Blow off any dust with dry nitrogen or clean, dry compressed air. Do not use canned Freon. Do not allow anything to contact active area on microchannel plate as this will cause plate to be noisy.



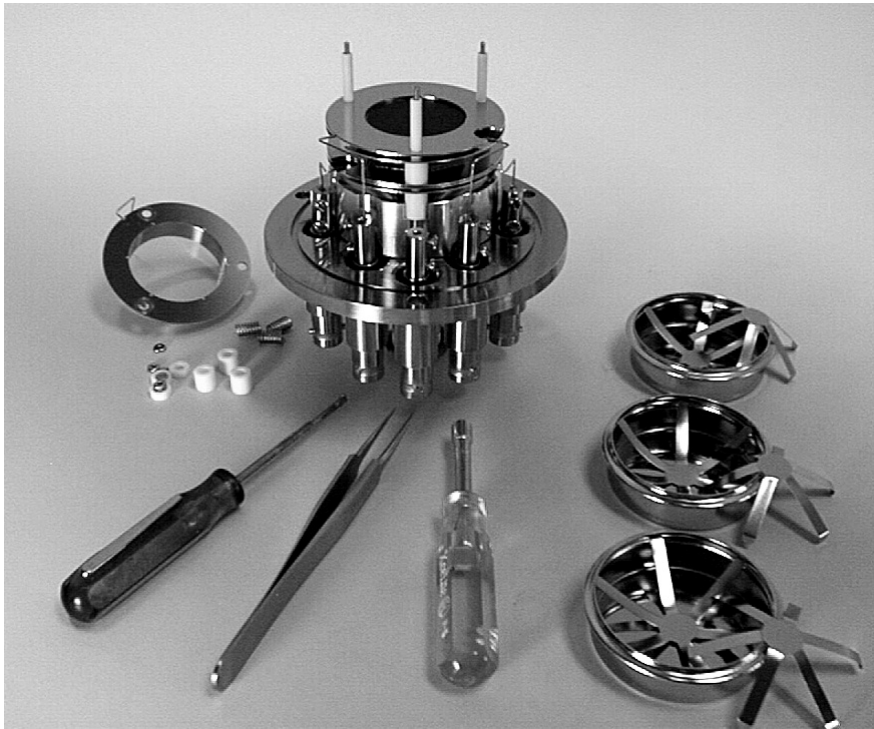
Note which direction Input Bias marker is pointed. Microchannel plates should be installed such that Input Bias markers point in opposite directions. This places plates in a "chevron orientation" providing maximum electron output.

- Put this plate on the hold down plate and center it.



16. Place the spacer on the channel plate.

17. Repeat steps #14 and #15 for the top channel plate.



18. Reinstall remaining Hold Down Plate. Guide lead into D4 barrel connector. Do not tighten the connector screw.

19. Replace spacers and springs.



20. Place Input Grid over ceramic inserts and hold it down evenly with fingers while replacing washers and nuts. Alternately tighten nuts one turn at a time in a circular pattern until all are snug. Do not over tighten.

21. Tighten the screws in the five barrel connectors.

Our TOF Power Supply generates voltages from zero to -5kV. The voltage divider then converts this to D1, D2, D3, and D4 for the detector.

